THE UNIVERSITY OF MELBOURNE

CENTRE FOR HEALTH PROGRAM EVALUATION

TECHNICAL REPORT 13

Predicting the Expected Costs of Health Care

Methods for Risk Adjustment in Health Services

Summary Report

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Dr Stuart Peacock
Senior Lecturer,
Health Economics Unit, Centre for Health Program Evaluation

Dr Leonie Segal
Deputy Director
Health Economics Unit, Centre for Health Program Evaluation

Professor Jeff Richardson
Director
Health Economics Unit, Centre for Health Program Evaluation

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The Co-ordinator
Centre for Health Program Evaluation
PO Box 477
West Heidelberg Vic 3081, Australia
Telephone + 61 3 9496 4433/4434 **Facsimile** + 61 3 9496 4424
E-mail CHPE@BusEco.monash.edu.au
Web Address http://ariel.unimelb.edu.au/chpe/

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1 Introduction

A key feature of the development of publicly and privately financed health systems has been the emergence of health 'schemes'. Despite major differences between health systems, these schemes possess a common theme: they are responsible for the delivery of health services for a defined population at risk over a given time period. They are largely the result of a global trend of devolving responsibility for health service budgets and delivery away from central government, which has occurred irrespective of the means of raising public finance, for example social insurance or taxation.

Health schemes have developed in many different forms, including insurance pools (US), sickness funds (Netherlands, Germany), and geographic areas (UK, Sweden). In order to provide services, health schemes receive a budget allocated from funders for which they are responsible. Often the funder is the central government, but in some cases other agencies, for instance state or local government or private insurers, may fund all or part of health service delivery. An integral part of the budget holding responsibility, is that health schemes bear some or all of the financial risk associated with the random variation in health expenditures across its enrollees. The devolution of budgets and service delivery responsibilities has led to increased scrutiny of the behaviour of health schemes with respect to expenditure control. Increasingly, emphasis has been placed on the determination of prospective budgets to allocate funds on a rational basis to health schemes, from which their populations' health services are to be provided.

The determination of prospective budgets requires estimation of the expected costs of health service use for the population covered by each health scheme budget. These predicted costs are used to set capitation rates – dollar amounts for each individual enrolled in a scheme – which typically indicate how much a health scheme would spend on an individual if it were to provide some standard level of health services. The prospective budget for each scheme is therefore made up of the number of enrollees weighted for their expected costs of health service use. The methods used to estimate the expected costs of health service use are collectively known as risk adjustment methods. Risk adjustment is the use of information to calculate the expected health expenditures of individuals over a fixed period of time to determine payment rates for health schemes. This paper seeks to summarise the literature on risk adjustment methods and the prediction of the expected costs of health care, and to provide a discussion of the relative merits of alternative approaches. Issues of particular relevance to the Australian context are highlighted. Fuller details and discussion are provided in the Full Report on this project (Peacock, Segal and Richardson 2001), which should read in conjunction with the Summary Report.

2 Predicting Health Service Costs

There is a substantial world-wide research agenda to develop risk adjustment methods to predict the 'expected'[1] costs of health services. The methods are used to develop risk-adjusted capitation funding models for health services. The modelling of health service utilisation and cost therefore represents a major research activity in many countries. The primary purpose of this research is the development of risk adjusted capitation-based funding formulae, to determine the distribution and level of health care resources. Capitation funding formulae determine prospective budgets for 'health schemes' based on the 'expected' costs of health service use of enrollees in those schemes. 'Health schemes' are agencies that are responsible for the delivery of health services for a defined population at risk over a given time period, and may be public or private sector bodies.

2.1 Risk Adjustment Methods for Predicting the Costs of Health Care

A number of methods may be used to estimate expected health service costs and determine prospective funding levels, including bilateral negotiations between the funder(s) and health schemes, or extrapolation of historical expenditure levels. Both of these approaches have been heavily criticised as they may promote arbitrary allocations of funds, and perpetuate existing inefficiencies and inequities in health services. In particular, many publicly financed health systems have used historically devolved budgets based on incremental adjustments to past expenditure and activity levels. This approach creates strong perverse incentives for health schemes to inflate expenditure levels to attract larger budget allocations in the future, whilst historically inefficient behaviour goes un-penalised, thereby promoting further inefficient behaviour. Inequalities in access are also perpetuated as health schemes with historically greater access - and therefore greater utilisation - are rewarded with greater funds, whilst health schemes with historically poorer access receive relatively lower funds.

The response to these criticisms has been the development of more scientific approaches to predict expected health service costs. These approaches have sought to provide accurate and robust estimates of expected health service costs that minimise the potential for perverse incentives when used to determine prospective budgets for health schemes. Scientific developments have focussed primarily on predicting costs to set capitated rates of reimbursement for health schemes. Capitation rates generally indicate how much a health scheme would spend on an individual if it were to provide some standard level of health services accounting for the influences of the individual's health, demographic and social characteristics on health service expenditure.

[1] As discussed in this Paper 'expected' expenditure is variously interpreted. While the simple interpretation is the mean health service use and cost implied by a particular mix of patient characteristics - the extent to which provider characteristics and behaviour (and costs), and broader health system delivery and funding arrangements should be brought into consideration vary.

The methods used to determine the influence of individual's characteristics on health service costs, and to incorporate those influences into capitation payments are collectively known as risk adjustment methods. A more technical definition of risk adjustment is the use of information to calculate the expected health expenditures of individuals over a fixed period of time to determine payment rates for health schemes in the pursuit of health system objectives (Van de Ven and Ellis 2000). The information used in risk adjustment methods seeks to capture the major determinants of health service expenditure.

In general, the determinants of health service costs/expenditure can be divided into two groups of factors: needs factors and supply factors. Needs factors may be defined as the demographic, health, and social characteristics of individual's that give rise to interpersonal differences in the need for health services and therefore expected health services costs. Supply factors may be defined as the organisational, managerial and policy characteristics of health service providers that give rise to variations in expected costs unrelated to the needs of individual's who receive services[2]. These provider characteristics reflect a range of potential sources of variations in costs. The main sources of variation in costs include variations in local clinical policy, managerial efficiency of providers, and variations in local availability of health services.

Supply side factors may also be divided into two groups: unavoidable and avoidable cost differences. Some aspects of efficiency and policy will be under the control of service providers whilst unrelated to the health service needs of individuals covered by health schemes. Supply side variations in costs that may be directly influenced by health schemes and that are unrelated to need may be termed avoidable cost differences. However, some aspects of efficiency and policy will lie outside of the direct control of service providers. These supply side variations in costs may be termed unavoidable cost differences. Unavoidable cost differences are generally due to variations in local factor input market conditions and in location specific costs of service provision. Local factor input market conditions may affect provider costs where local wages and rents vary according to the extent of local labour market conditions, availability of land etc. Location specific costs of service provision may affect provider costs where the physical location of health services and populations influence the costs of service delivery.

Risk adjusted capitation formulae may encompass just acute care services, primary care services, or all health services, (variously defined). Risk adjustment methods and capitation funding are used in both non-competitive health scheme models (for example Canada, the United Kingdom and Australia) and competitive health scheme models (for example the United States and the Netherlands). Competitive models allow health schemes to compete for enrollees (for example under private health insurance or managed competition), whereas under non-competitive models competition for enrollees is not permitted (for example where health schemes have a defined geographical catchment area).

Under the competitive health scheme model health schemes are allowed to compete for enrollees under a range of possible financing and delivery arrangements, for example

[2] This distinction has also been drawn by Rice and Smith (1999) – who use the terms legitimate and illegitimate factors – and Van de Ven and Ellis (2000) - who use the terms solidarity and non-solidarity factors. Whilst the terminology adopted elsewhere reflects the normative judgements required in determining factors relevant for capitation, we will distinguish between needs and supply factors to avoid what may be considered overly value laden terminology.

competitive health insurance, managed competition etc. A principle role of risk adjustment in this type of model is the promotion of efficiency in the operation of the insurance market (Rice and Smith 1999). Risk adjustment, in this context, seeks to ensure that capitation payments are adequate to cover predictable future expenditures for enrollees to minimise the potential for adverse selection and cream skimming (Hutchison et al 1999). Cream skimming and adverse selection refer to the practices of attracting enrollees for whom the risk adjusted payment is greater than expected cost, and to discouraging enrollees where payment is less than expected cost.

Under the non-competitive health scheme model health schemes are not permitted to compete for enrollees, for example enrolled populations are determined by geographically defined administrative regions, employee insurance schemes etc. Incentives for adverse selection and cream skimming are therefore largely removed. A major role of risk adjustment under this model is the pursuit of explicit equity objectives (Rice and Smith 1999). Typically, explicit equity objectives have related to equal funding for equal need, or equal government subsidy for equal need across health schemes which individuals are compelled to join (Rice and Smith 1999).

Under all health scheme models, risk adjusted capitation funding models consist of four main elements reflecting the major determinants of health service costs (Peacock 1997):

(i) The number of persons covered under each health scheme,

with weights for health scheme enrollees to reflect:

(ii) their demographic related health care needs
(iii) their health status and social related health care needs
(iv) differences in the costs of service provision due to supply side factors.

The weights for supply side factors may be divided into weights to reflect:

(a) avoidable cost differences eg service provider efficiency, managerial and clinical policies
(b) unavoidable cost differences eg local factor input market conditions and location specific costs

The weights used in capitation funding models are derived from predictions of the expected costs of health services estimated using risk adjustment methods. All capitation funding models therefore employ a standard approach of calculating per capita rates based on individuals' expected costs of health care. The prospective budget of an individual health scheme is found by aggregating the expected costs of health care for all individuals enrolled with that scheme.

Risk adjustment methods have concentrated on the development of regression models to explain variations in health service utilisation and cost in terms of the demographic, health, and social characteristics of individuals (needs factors) and the organisational, managerial and policy characteristics of health service providers (supply factors). These models have been used to predict the expected costs of health care for individuals, accounting for interpersonal differences in the need for health services, and in some instances, differences in the supply side characteristics of health service providers. Differences between capitation models emerge only in

the robustness of risk adjustment methods used to estimate expected health service costs, and in the choice of needs and supply factors that are used to predict costs.

2.2 Criteria for Assessing Risk Adjustment Methods

A number of studies have identified a range of interrelated criteria for assessing alternative approaches to risk adjustment (Van de Ven and Ellis 2000, Rice and Smith 1999, Hutchison et al 1999). The criteria proposed across these studies are broadly consistent, and have been grouped under four headings: appropriateness of incentives, validity, feasibility, and acceptability.

(i) Appropriateness of Incentives

The appropriateness of incentives generated under risk adjusted capitation payments is the most important criteria over which risk adjustment methods should be assessed (Van de Ven and Ellis 2000). There are many possible distortions or undesirable responses created by a given set of risk adjustment factors, and the extent to which these compromise the objectives of the capitation system is a pivotal issue evaluating alternative risk adjustment methods. These potential undesirable responses broadly relate to:

- the explicit selection of some patients over others (adverse selection);
- the oversupply of services to profitable patients, and the under-supply of services to unprofitable patients (cream skimming);
- the oversupply of services to patients and population groups with relatively low levels of need, and the under-supply of services to patients and population groups with relatively high levels of need (inequities in access); and,
- the distortion of information for payment purposes to funders (gaming the system).

The first three responses reflect the most common objectives of capitation systems – equity and efficiency - and will be applicable with varying degrees of importance depending on the particular context under consideration (e.g. whether the health system model is competitive or non-competitive). The fourth response is dealt with below under the criteria of feasibility.

(ii) Validity

The most common criteria against which risk adjustment methods are assessed in practice is the validity of methods to predict future health expenditure, where validity is defined as the degree to which a measure actually assesses what it purports to measure. The reason for the focus on validity lies mainly in the relative ease with which the performance of statistical models may be evaluated. However, whilst appropriateness of incentives remains the most important criteria for assessing risk adjustment methods, validity may still provide useful information on the relative performance of alternative methods. Furthermore, if the objective of risk adjustment is simply to gain the most accurate prediction of future expenditure as is possible, then validity may become the most important evaluation criteria.

The most commonly used measure of the validity of risk adjustment methods is the predictive power of regression models used to select and weight needs and supply factors. This reflects the

predominance of empirical (regression) techniques in risk adjustment. Typically the R^2 value for regression models has been used to assess predictive power. The R^2 value in individual level regression models measures the proportion of variance in individual expenditures that is explained by a set of individual and health scheme level, needs and supply factors. In aggregate level (small area) regression models it measures the proportion of variance in (small area) population expenditures that is explained by a set of (small area) population level needs and supply factors.

(iii) Feasibility

Feasibility may be split into three main considerations in developing risk adjustment models: the availability of data, resistance of data to manipulation, and administrative feasibility.

A number of principles should be applied to the data on which risk adjustment is to be based (Rice and Smith 1999). Needs factors should be based on individuals' characteristics that are: universally recorded across schemes in receipt of funds, consistent, verifiable, free from perverse incentives, not vulnerable to manipulation, consistent with confidentiality requirements, and plausible determinants of service needs. Typically, individual data suitable for risk adjustment is more readily found in health systems which have developed and used insurance claims in reimbursement (whether private or social insurance). The regulatory requirements for providers and health schemes to submit claims for patients under this approach have provided some very rich data sources for risk adjustment. However, the lack of a national identifier to link records in some countries (eg Australia) may severely limit the ability of funding agencies to develop a coherent approach to risk adjustment that provides appropriate incentives for providers. Without proper record linkage analysis of expenditures and needs factors cannot be carried out across the whole spectrum of health services. Appropriate incentives for efficiency and equity may then be limited to a subset of services, with incentives between broad service areas at best weak, and at worst inappropriate.

There is a need for analysis to identify needs factors that cannot be manipulated by the health schemes, or that create perverse incentives (needs factors should be exogenous to health scheme decision making). Needs factors that may be prone to manipulation by health schemes include historic expenditure, diagnosis-based measures and health survey measures. Historic expenditures are not commonly used as needs factors in risk adjustment, in part because of the ease with which health schemes can manipulate such data. Diagnosis and survey based measures may be more difficult to manipulate.

Administrative feasibility requires that data are available for all individuals covered by health schemes (and all potential enrollees) with relatively little effort required (and hence low administrative cost) for data collection (Van de Ven and Ellis 2000). Again such (individual level) data may be more common in insurance claim based health systems. For data to be readily available for use in risk adjustment it should be routinely collected, standardised and comparable across health schemes, of acceptable quality, and easily validated. Large and representative samples should exist on which risk adjustment models can be developed and calibrated before implementation. Time lags between data collection and its availability for use in risk adjusted funding mechanisms should be minimised to ensure data is up to date, and data should be updateable so that analysis and weights can be re-calibrated over time.

(iv) Acceptability

A key element of risk adjustment, often overlooked, is that it should be acceptable to key stakeholders. If risk adjustment methods and results are not accepted by even one key stakeholder group, the chance of risk adjustment being successfully implemented become small. Specific stakeholder groups will include the general public, patients, providers, health schemes, funders and politicians. Acceptability concerns may span a wide range of considerations, often depending on the country and context within which risk adjustment is being developed.

Examples of acceptability considerations for the public and consumers may include whether risk adjustment penalises sub-populations who have historically under-utilised services; whether privacy of information requirements are sufficient, particularly for diagnosis based information; and whether risk adjustment based on certain characteristics, eg race, is ethical (in some sense). Provider and health scheme concerns may include whether risk adjustment is based on clinically meaningful distinctions; the extent to which clinical freedom may be limited; and the level of financial risk to be borne by the scheme. Funders and politicians concerns may include whether the risk adjustment model is transparent and simple; the level of financial risk borne by both schemes and funding agencies; and the extent to which incentives are consistent with broader social and economic goals. In broader terms, acceptability also requires that risk adjustment and capitation is understandable to all stakeholders – i.e. it should be transparent, conceptually simple, and credible with respect to the relationship between level of need and level of funding (Hutchison et al 1999).

3 Risk Adjustment Methods

Simple historic expenditure approaches to budget setting - where future budgets are based on current utilisation and incremental adjustments that do not account for differences in enrollees health care needs - will perpetuate and promote inefficiency and inequities in the health system. Even if the primary goal of budget setting is the creation of the budget itself, it is unlikely that the incentives produced by historic expenditure approaches will be acceptable to policy makers and the public. Sound risk adjustment methods are required.

Overseas risk adjustment models cannot be directly imported because health expenditures in Australia reflect a different set of health system delivery and finance methods than found elsewhere, and the relationship between needs, supply and expenditure in Australia will differ from that found overseas. Detailed analysis is required in the Australian context, using Australian data.

Poorly conceived risk adjustment methods have typically failed overseas. Implementation in such circumstances has rarely been achieved. The major advances in risk adjustment have been in the US, the UK and the Netherlands. In these countries risk adjusted capitation models have been successfully implemented, with efficiency and equity gains. This has only been possible through significant investment in research to develop sound models and methods. Where this investment has not been made capitation models enjoy relatively limited success.

3.1 Individual Level versus Aggregate Level Analysis

Risk adjustment models have been based either on individual/patient level data or small area data (such as census collector district or postcode). Typically small area data has been used in the non-competitive health scheme models. This is primarily because individual level data is less commonly found in health systems where individual insurance claims data is not required. However, under a non-competitive model, it may be less critical to establish a correct capitation weight for each individual. There is limited potential for risk selection where enrollment is dictated by factors outside health scheme control (such as geographic location), and budgets are typically set for a defined population group.

In theory, the use of individual level data is preferable, regardless of health scheme type. Individual level analysis allows for more precise estimation of individual's expected costs, because it allows more accurate description of the relationship between health service use and costs, and individuals' demographic, health and social characteristics. Small area data does not capture the full extent of heterogeneity between individual's within small areas, and may result in less precise predictions of costs at the individual level. Aggregate level summary measures of need in a given population do not necessarily reflect the sum of the needs of the individuals that go to make up that population. This is often referred to as the ecological fallacy - inferences made from aggregate level analysis may not hold at other levels of aggregation.

In the context of risk adjustment, relationships found between needs factors and utilisation/costs at the aggregate level may not hold at the individual level. This may cause problems in the use of aggregate level models for the risk adjustment of capitation payments. More importantly, the purpose of risk adjustment is to estimate the link between individual's needs and health expenditure. This holds even if payments are made at the health scheme level (rather than at the individual level) because resources allocated at the scheme level are still intended to lead to the most appropriate patient care for individuals.

The gold standard approach to risk adjustment should therefore be to utilise individual level data wherever possible. Furthermore, the most appropriate design would be to analyse a large cohort of individuals to robustly estimate relationships between needs factors and expenditure over time.

3.2 Capacity of Models to Predict Health Service Costs

The capacity of models to predict health service use and cost depends primarily on the structure of the model, the choice of explanatory variables, whether individual or small area data is used, and the scope of services covered. Whether the capitation formula is consistent with the financial survival of health schemes will depend on the extent to which unexplained variation is a reflection of random error (rather than statistical bias), scheme size in terms of number of enrollees, and strategies for risk sharing.

Using individual level data, it has been estimated that capitation models can predict up to 20-25% of variation in health service costs. This is widely held to represent the proportion of health

service costs that is potentially explicable under statistical analysis. The remaining 75-80% of variation in costs is due to random factors. In practice, many capitation formulae based on individual level data have reported that 10-12% of the variation in costs was explained in regression modelling. Studies of selected types of health services have demonstrated less random variability in costs for some services, for example chronic care and pharmaceuticals, and have reported as much as 56% of variation in costs explained in modelling (see Peacock, Segal and Richardson 2001).

In relation to financial survival of health schemes, even risk adjustment models which explain only 10% of individual level variation will be likely to cover actual costs, provided the enrolled population is of sufficient size (and budgets reflect predicted cost). Whilst little empirical work has been carried out on optimal scheme size for capitation formula based on individual level data, an enrolled population of 5,000 is suggested as sufficient to minimise the risk of financial insolvency due to random influences on costs.

The percent of variation in health service cost predicted by models using small area data tends to be higher, at around 55%. This is not because of any superiority in the model structure, but because the combination of data, on the cost side as well as in relation to independent variables, removes substantial variation in the data. However, in translating to financial robustness of schemes, far larger enrolled populations are required.

At an enrolled population of 10,000 persons it has been estimated that approximately 17% of Schemes would find expenses more than 10% in excess of capitation payments, (where small areas used in analysis have an average population of 10,000). This proportion falls rapidly to 0.1% for an enrolled population of 100,000 persons.

3.3 Typical Explanatory Variables in Risk Adjustment Methods

Variables used in capitation models are drawn from a range of measures for needs factors and supply side factors. Typical examples of needs and supply factors are shown in tables 3.1 and 3.2.

Prior diagnosis information may represent a particularly important needs factor for exploration in future research. This could be achieved by initially importing tools such as the Boston Diagnostic Cost Group (DCG) framework, and developing it in the Australian context (in much the same way Diagnosis Related Groups were imported). However, it is highly unlikely that DCGs will be directly transferable because of the significant differences between the Australian and US health systems.

A wide range of potential needs factors should be considered in any analysis. Competitive health scheme approaches to capitation have been weakened by their failure to consider broader determinants of health and health needs. Non-competitive approaches have been much more thorough in their treatment of a range of needs factors. Modelling techniques should include consideration of both the potential interrelationships between supply, demand and expenditure, and the hierarchical nature of health service organisation and delivery. This requires sophisticated approaches to regression modelling, including the use of multilevel modelling techniques.

Table 3.1 Examples of needs factors

Category	Potential Measures
Demography	Age Sex
Ethnicity	Disadvantaged ethnic groups - eg ATSI/Other, Maori/Pacific Islander/Other
Employment/Disability Status	Unemployment/Welfare Status – employed, unemployed, pensioner Unemployment/Disability – temporarily unable to work, permanently sick
Health Status	Self reported/survey-based morbidity Permanent disability/dependency status Mortality rates (crude and standardised) Previous inpatient/outpatient diagnosis Low birth weight
Socioeconomic Status	Homelessness Martial status/cohabitation Income Socioeconomic Status/Social class Education level Religion Elderly Living alone Housing tenure/quality No carer in household
Geographic location	Region/area of residence Rurality Urbanisation Remoteness Population Density

3.4 Supply Side Factors and Risk Adjustment

Alternative stances to the treatment of avoidable cost differences (at the health scheme and provider level) have been adopted in the risk adjustment methods applied. Avoidable cost differences refer to these supply side factors endogenous to the health scheme – within the scheme's control – including managerial efficiency and local policies and practices. Potential sources of avoidable cost differences include, historical inequities in access, and variations in prescribing patterns and procedure rates which cannot be justified in terms of need, cost-effectiveness or equity grounds. Essentially risk adjustment may seek to include or exclude avoidable cost differences from capitation funding. Each approach may be valid for the stated objectives of capitation funding in alternative contexts.

Table 3.2 Examples of supply side factors

Category	Potential Measures
Provider Characteristics – exogenous to health scheme	Input prices Labour prices Capital rental prices Location specific service delivery costs – excess rural service delivery costs Rurality Urbanisation Remoteness
Provider Characteristics – endogenous to health scheme	Market power - ability to get price discounts Insurance coverage features - deductibles, co-payments etc Contracting arrangements Practice style Health scheme management policies and practices

Those health systems that have included avoidable cost differences in capitation payments have done so primarily to reduce the potential for risk selection by health schemes. Attempts to correct for avoidable cost differences under capitation may promote cream skimming behaviour. If a relatively inefficient (high cost) provider is reimbursed at the average efficiency rate of payment then it will seek to reduce costs (improve efficiency). One potential means of reducing costs is to cream skim. Therefore, attempts to influence supply side behaviour through capitation payments may create perverse incentives that run contrary to the underlying goal of capitation in a competitive health scheme model. This has led to a focus on capitation payments that reflect variation in costs in competitive health scheme models, irrespective of the source - need or supply side - of that variation.

Those health systems (mainly non-competitive) that have excluded avoidable cost differences have done so primarily in the pursuit of equity objectives. Capitation to promote equity has focussed on payment rates based on predicting costs in terms of individuals' health service needs, where rates are corrected, or adjusted, for avoidable cost differences. The correction for avoidable costs implies each health scheme receives payment based on an individual's health service needs given some standard level of circumstances. The reimbursement rate reflects the expected cost for an individual with a given level of need adjusted for the average impact of variations in clinical policy, managerial efficiency, and the availability of health services on costs. For example, for a given level of population need, a health scheme that has higher utilisation (and hence costs) because of historically high access to services receives the same payment as a scheme with low utilisation due to historically poor access. In this way, capitation may be used to correct existing inequities in service provision between health schemes, by using relative resource shifts from high access to low access areas.

3.5 Population and Service Coverage

Little attention has been given to the scope of services to be included in health schemes. However, this has significant implications for the development of risk adjusted formulae and incentives for cost shifting. In general, the narrower the scope of services covered, the greater the capacity for cost-shifting to services not included in the formula. But where quite distinct service types are to be covered, (such as acute care, mental health, primary care, residential care), it is probable that a number of distinct capitation formula will need to be developed.

In particular, the choice of a regional population based model or a targeted high risk enrolled population, has fundamental implications for the approach to capitation, and the likely robustness of the model. There are arguments both ways. The potential advantages of a population-based approach include:

- greater certainty in numbers to whom the capitation rate is to apply;
- the possibility of developing a generic capitation based funding formula that can be applied across the nation, rather than relating only to a unique enrolled population;
- greater opportunity to introduce system wide change;
- greater opportunity to introduce prevention approaches to care;
- reduced opportunities for cost shifting outside the scheme;
- possibility of funding at the regional level rather than via individual agencies;
- there is no opting out, and no issues of either cream skimming or individuals (eg those now incurring high costs and not wanting to be monitored) selecting not to participate;
- the model would not offer choice of scheme, but could potentially encourage competition amongst providers;
- facilitate a strong health services planning focus to ascertain community preferences, relative access to services, capacity of the system to deliver best practice/ cost effective care.

On the other hand there are a number of difficulties with moving to a population-based model and some advantages of a targeted approach. These include:

- reduced establishment costs, the possibility of implementing a larger number of smaller schemes, all of which can provide important lessons;
- the possibility of gaining informed consent to gather patient level data, which might not be possible in a population based approach, just by virtue of the numbers involved;
- the possibility of targeting particular high needs groups that may most benefit from care coordination/integrated care;
- with a defined target it is possible to enroll a control population which provides a means for checking the viability of the budget calculation and assessing the impact of the health funding and delivery model on health services use and cost and health outcomes.

3.6 Approaches to Risk Sharing

There are several possible approaches to risk sharing. These are necessary because health service costs are subject to significant random variation, and risk adjustment methods may only imperfectly estimate the relationship between needs and supply factors, and health service costs. Both may expose health schemes to significant financial risk. Increased scheme size is probably the most important means to contain risk. But even in larger schemes a small risk of insolvency may remain. Risk may also be reduced through exclusion from the capitation formula and scheme responsibility of nominated high cost activities, and/or the most expensive x% of cases. The presumption is that the costs of such 'outliers' will be met at the funder/national level (or at least beyond the scheme level).

Strategies for risk sharing using blended payments (a mix of capitation and retrospective reimbursement) are an effective tool for managing financial risk to budget holders. Outlier and proportional risk models provide some protection against insolvency for budget holders. Condition-specific and service-specific risk sharing may also be useful strategies, but evidence is sparse for these arrangements.

What also seems clear is that provided the population is of a reasonable size, which might be as low as 5,000 persons (or even less), random variation may not be excessive. Reduction in risk through, say the exclusion of certain service types from the pool and the capitation rate, may be unnecessary, and contradictory to the achieving resource shifts between programs. The financial viability health schemes is likely to be influenced more strongly by an incorrect capitation rate, high administration and management costs, and cost pressures outside their control.

In the Australian context the existence of services over which the scheme manager has no control, notably access to MBS, PBS and to a lesser extent public hospital services, represents an important issue that needs to be addressed. Similarly how to manage costs pressures, such as the relative use of private hospitals and thus private fee-for-service doctors which are outside the control of the scheme manager needs to be debated.

4 Capitation Issues in Australia

In order to progress the debate about risk adjusted capitation funding in Australia and the prediction of expected costs of health care, there are a number of issues that require attention. This paper has endeavoured to address the main issues in risk adjustment methods for predicting health service costs to contribute to a dialogue about health service funding and heath system reform in Australia. This Section aims to bring together the discussion about risk adjustment methods and capitation funding to highlight key issues in its application in the Australian context. We suggest some preliminary conclusions can be drawn at this stage, but also some research questions around which the debate has only just started.

4.1 Capitation Funding and Australian Health Services

Capitation funding, where health schemes receive funding commensurate with the expected health service costs of their enrollees, is relatively widely used across the world. It is also used in a number of contexts in Australian health services. The most notable example of capitation funding is the New South Wales resource distribution formula, which determines funding levels for Area Health Authorities. Other examples include the basis for some payments made to the States by the Commonwealth through the Health Care Agreements, and a range of individual health service programs funded at the Federal and State levels, notably the nursing home program.

Capitation funding may be a desirable option for devolving health service budgets for a number of reasons. Capitation provides an effective mechanism for capping budgets to secure cost containment. Where competition is allowed between health schemes, capitation can be used to reduce the potential for adverse selection and cream-skimming through the use of risk adjustment methods to predict health services costs. Irrespective of whether or not competition between health schemes is allowed, capitation can be used to pursue equity objectives, through the use of risk adjustment methods. Finally, if capitated budgets are used to break down traditional budget boundaries, capitation funding may be integral to moves to improve coordination and integration of care, with the potential to improve cost-effectiveness in service delivery and allocative efficiency in the health service mix. Thus, capitation funding has the capacity to provide significant benefits and meet health service objectives in a number of areas.

For example, at present casemix funding in many States, is used primarily to determine throughput volumes against hospital budgets, determined essentially on historic budgeting rules. Historic budgeting tends to promote existing inefficiencies and inequalities between health schemes. Capitation funding could be employed, in this context, to calculate acute sector budgets based on the expected costs of health services reflective of the underlying health service needs of a population served by particular hospital(s). Payment for individual services could still be made on the basis of DRG case payment, in the pursuit of efficiency in service delivery. In this way capitation funding and casemix funding could be combined to more effectively pursue health system objectives as they relate to cost containment, efficiency (both technical and allocative), and equity (Peacock and Segal 2000).

There exist a wide range of other contexts in which capitation funding may be beneficial, the majority of which are not described within the context of this paper. However two further examples are worth some attention.

(i) The Coordinated Care Trials

In the context of the Australian Coordinated Care Trials, the development of risk adjusted capitation formulae is a fundamental requirement for Funds Pooling, a central feature of the Trial model. Predicting the expected costs of health services for enrollees is especially important because the financial viability of Trials is dependent on Trial managers being able to cover the costs of care from the Funds Pool. Further, if the Trial becomes insolvent, a range of other objectives will not be met. The use of historically determined budgets, based purely on the average costs of treatment in previous years, may expose Trials to a significant risk of becoming

insolvent. This is because simple historic budgeting approaches do not properly account for differences in personal characteristics and organisational characteristics that influence enrollees' expected health service costs. This requires a system of risk adjusted capitation. Otherwise enrollees may be refused access to services through the trial based on their characteristics, quality of care may be reduced, or the Trial may become insolvent.

The funds pool model adopted by the coordinated care trials is quite different to the models common overseas (US, UK and Europe), to which most of the capitation literature is addressed. The difference lies in the source of funds for the pool. Under most capitation models, funds are contributed by a single funder (or at most two or three), usually the national government, or private health insurer. However, under the Australian coordinated care trials, the Scheme manager must obtain funds from the programs and agencies, from revenues they have received from the funders. There are thus two separate requirements in setting up a robust Funds Pool, firstly to ascertain a technically correct funding/capitation rate, and secondly to negotiate with the numerous agencies to contribute at the technically correct rate.

This creates two major hurdles that are unique. In calculating the capitation rate, rather than a single (or perhaps three or four) risk adjusted formulae being developed by the funder, current program boundaries dictate the need to develop numerous separate risk adjusted models. Secondly, even if a robust capitation formula can be developed for each agency, there is no guarantee the agency would be persuaded to contribute at that rate. In fact, as the explicit aim is to achieve resource shifts, to purchase care co-ordination services from the Pool and meet additional administrative and management costs from the Pool, agencies may have little incentive to contribute at the calculated rate based on the expected cost of usual care.

There are therefore two separate issues: to ascertain a technically correct risk adjusted funding rate, and to negotiate contributions to the pool at the correct rate from numerous agencies. A logical alternative is for the primary funders to directly contribute to the Scheme, withdrawing an equivalent amount from each agency to cover the additional administrative and management costs of care coordination.

(ii) Budget Holding under Integrated Care and Managed Competition Models

Under moves to an integrated care model, many existing budget boundaries may be removed, (as in the UK Primary Care Group model). The broad aim of this type of health system model is to remove artificial budget boundaries to promote the cost-effective use of resources across a wider range of health services. This model attempts to promote allocative efficiency within a more holistic population health focus. To do so capitation funding may again be pivotal. By allocating funds to health schemes on the basis of enrollees' need for health service resources, risk adjusted capitation funding would form a more rational basis for the pursuit of allocative efficiency.

In the wider context of health service reform, risk adjusted capitation funding is a fundamental plank in the development of managed competition and/or integrated health care models. Managed competition model implies competition for enrollees by health schemes. This require a capitated payment per enrollee, be allocated to schemes. This capitated amount would have to be adequately risk adjusted to reduce incentives for adverse selection and cream skimming. Risk

adjustment methods may be used to address equity objectives under managed competition, or under non-competitive health scheme models.

4.2 Research Questions for Australia

There is a substantial world-wide research agenda to develop risk adjustment methods to predict the expected costs of health services. A rigorous approach to the research task is critical, in order to engender confidence in the resulting formula in terms of its robustness, transparency and ability to provide correct incentives. Inappropriate risk adjustment methods can result in insolvency for health schemes, or in the competitive context, perverse incentives for risk selection (cream skimming and adverse selection). It is hoped that this Paper will contribute to an on-going dialogue about health system funding and delivery and the role for risk adjustment and capitation funding in Australia. The types of issues that will ideally be explored as part of this debate are listed below:

(i) Health System Objectives and the Role of Capitation Funding

A robust debate about the objectives of the health system and the possible contribution of risk adjusted capitation to those objectives is desirable. It is of particular importance to ascertain the views of policy makers and the community about the relative importance of efficiency, equity, and access. While sometimes equity and efficiency objectives will be complementary, there may also be conflict between goals, requiring choices and trade-offs. Such trade-offs require value judgements, which cannot be determined through regression based risk adjustment modelling. This matter is central to the development of an appropriate capitation rate. It is necessary to determine what it is designed to do. Is it merely to replicate past expenditures and historic access to services, or is it to be used to redistribute resources to ensure a fairer access to services - however that is defined?

(ii) Supply Side Factors and Risk Adjustment

Risk adjustment methods have differed in their treatment of avoidable cost differences - supply side factors within the scheme's control, including managerial efficiency and local policies and practices. Risk adjustment may seek to include or exclude these sources of variations in costs, from capitation funding. Those health systems that have included avoidable cost differences in capitation payments have done so primarily to reduce the potential for risk selection by health schemes. Those health systems that have excluded avoidable cost differences have done so primarily in the pursuit of equity objectives.

A discussion is required in the Australian context about the objectives of the health system and the implication for the treatment of variation in cost attributable to supply, in relation to variables within and outside the control of the Scheme. A number of options exist that may represent valid objectives and approaches to avoidable cost differences. The primary objective of risk adjusted capitation may be to pool funds in the pursuit of efficiency gains from service substitution. Equally, risk adjusted capitation may seek to reduce any potential for risk selection and quality scrimping. In both cases it may be appropriate to include avoidable cost differences in capitation

payments. However, capitation funding may also be used to promote equity in access to health services. In this case it may be appropriate to exclude avoidable cost differences.

Each approach may be valid for the stated objectives of capitation funding in alternative contexts. Experiences from overseas suggests that these, and other, potential objectives require considerable debate and research before a robust capitation model can be implemented. Research issues include the extent to which these objectives are relevant to the Australian context, the degree to which objectives are complementary, what trade-offs between objectives may be required, and the development of risk adjustment methods appropriate for any given set of objectives.

(iii) Population and Service Coverage

Decisions need to be made about the services to be provided by health schemes and therefore included in risk adjusted capitation formulae. Options include for instance, primary medical care only, all primary care, primary plus secondary, plus selected or all tertiary care, plus residential care. It may also include selected components of disability and welfare services. These decisions should reflect the potential for improvements in allocative efficiency through service substitution from the removal of budget boundaries.

(iv) Capped or Open-Ended Budget/Treatment of Private Health Insurance

In adopting a risk adjusted capitation based model of funding there is a presumption that health service costs can be constrained by the scheme management. Costs which are outside the control of scheme management, might be determined outside the capitation arrangement. This might include both regional based supply side variables such as input prices, or travel costs associated with distance, but might also need to accommodate national commitment to unrestricted access to certain types of services. Thus access to private medical services included on the MBS and PBS are guaranteed, and not able to be the subject of restriction. Similarly conditions of access to public hospitals are dictated by joint Commonwealth State Agreements.

Access to services funded through private health insurance may also not be within the control of scheme managers. How these issues can be, and are to be, reconciled within a risk adjusted capitation funding model need to be explored.

(v) Support for a Research Program to Develop Capitation Formulae

The wider adoption of capitation based funding is an important possible future direction for the Australian health system. Progress in this area relies heavily on two types of research:

- into the exploration and development of risk adjusted capitation funding models
- into the characteristics of the Australian health system, and how or whether they can be reconciled with risk adjusted capitation funding

The three countries which have led the way in developing risk adjustment methods, and in successfully implementing capitation funding models – the US, the Netherlands and the UK – have all devoted significant time and resources to these key research tasks. Experiences have

been remarkably similar in all three countries: that a core group of three to five researchers working over a period of two to three years is required, as a minimum, to develop methods and analyses to construct robust risk adjusted capitation formulae, that will provide appropriate incentives consistent with health system objectives.

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